

School of Information Systems

**Information Systems Strategy and Knowledge-Based
Small and Medium-Sized Enterprises:
An Investigation within the Australian Biotechnology Industry**

Volume One

**Submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy**

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A handwritten signature in black ink, appearing to read 'Jayne Clarke', with a long horizontal flourish extending to the right.

Jayne Clarke
November 2005

Abstract

This thesis explores the nature of information systems strategy (ISS) within twelve Australian biotechnology knowledge-based small and medium-sized enterprises (KSMEs). Over the last two decades there has been considerable interest, within both the academic and business communities, on the role information systems (IS) plays in competitive advantage. To date, most of the ISS models, frameworks and techniques that have emerged, have been derived from empirical research based on large organisations. More recently, a research focus has begun to explore ISS amongst small and medium-sized enterprises (SMEs). Within this research focus, KSMEs have been identified as businesses where ISS could be particularly beneficial. Research to date investigating ISS within KSMEs has been exploratory and has tended to rely on only a single strategic management perspective, the resource-based view (RBV). A possible limitation of this perspective in respect of ISS is that it may not encapsulate the full range of sources of advantage. Furthermore, the firm-level focus of current approaches suggests that ISS theory may have had little opportunity to explore sources of competitive advantage beyond the firm boundary.

In this context, the thesis conducts research within the Australian biotechnology industry. At a substantive level, the biotechnology industry has been identified as one of the most knowledge-intensive, has yet to be explored by the IS discipline. Through the conduct and analysis of twelve case studies, this research develops an explanatory model of the nature of ISS within Australian biotechnology KSMEs. The twelve case studies involve KSMEs from both within the agriculture and human health sectors of biotechnology in Australia.

The research design encompassed four key elements - research philosophy, research strategy, research procedures and research principles. The research philosophy involved a subjective ontology and employed an interpretative epistemology. The research strategy involved three stages - familiarisation stage, pilot interview stage and a primary investigation stage. The primary investigation involved a qualitative research approach within a multiple case study framework. The primary investigation included a series of semi-structured interviews with managers of twelve Australian biotechnology KSMEs. Interview transcripts and organisational artefacts were analysed using qualitative data analysis techniques influenced by several principles often associated with grounded theory method. An inductive approach to theory generation was adopted whereby theories, concepts and models were derived directly from the data or grounded in the data.

The thesis makes contributions to IS research, particularly within the SME and ISS discourses at three levels. At the substantive level, the research provides an in-depth study of the nature of ISS within twelve KSMEs in the Australian biotechnology industry. The research provides a detailed description of the 'biotechnology landscape' and identifies a number of potential challenges, which needed to be addressed in the research design. The purpose of the detailed description is to assist with the conduct of this research but will also assist other IS researchers investigating the biotechnology industry.

At the methodological level a number of contributions are made to IS research. Firstly, an innovative approach of applying the principles of critical reflection to pre-data collection phases is developed. The adoption of critical reflection at the research design stage is shown to enhance research rigour and the explication of the appropriateness of the research design with respect to factors including the research questions and research context. Secondly, the research method also develops an approach suitable for investigating highly commercially sensitive topics. Thirdly, the research approach uses a heuristic tool, which integrates multiple levels of analysis (i.e. firm, interfirm, and industry levels). The heuristic tool is designed to assist the researcher ascertain factors that may need to be considered to model current ISS in Australian biotechnology KSMEs. Finally, a two-stage data analysis process is developed for analysing qualitative data incorporating grounded theory data analysis techniques within a multiple case study framework. The two-stage data analysis process combines the strengths of a holistic case study and a cross-case study approaches and through the selective use of grounded theory techniques, provides a method to extract rich, detailed meaning about the emergent concepts, themes and interrelationships within multiple cases. The development and deployment of the research approach was also underpinned by an awareness of Klein and Myers (1999) principles for conducting and evaluating interpretivist research.

At a theoretical level, this thesis has generated an explanatory model of factors influencing the nature of ISS within Australian KSMEs, which extends current insights into ISS in KSMEs. Several challenges in relation to the current conceptualisation of ISS are also identified in respect of reassessing strategic alignment, the conceptualisation of IT as a tool or agent of change, firm boundary permeability, the conceptualisation of SMEs and the potential application of the socio-technical perspective. In addition, it discusses the potential risk to the IS discipline if researchers continue to adopt a single strategic management perspective. The research concludes by suggesting an integrated perspective is the most appropriate approach in exploring complex, dynamic business environments. It is anticipated that the model and insights gained will lead to further advances in IS research in SMEs within the knowledge economy.

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Acronyms

ABS	Australian Bureau of Statistics
ANZFA	Australia New Zealand Food Authority
ANZSIC	Australian and New Zealand Standard Industrial Classification
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service
AUD	Australian Dollar
CRC	Cooperative Research Centres
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVMP	Committee for Veterinary Medicinal Products under the
DNA	Deoxy Ribonucleic Acid
EMA	European Medicines Evaluation Agency
EPC	European Patent Convention
EPO	European Patent Office
ERP	Enterprise Resource Planning
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FDA	Food and Drugs Administration
GM	Genetically Modified
GMO	Genetically Modified Organism
IP	Intellectual Property
IPR	Intellectual Property Rights
IS	Information Systems
ISAA	International Service for the Acquisition of Agri Biotech Applications
ISS	Information Systems Strategy
IT	Information Technology
KSME	Knowledge-based Small and Medium Sized Enterprises
NOHSC	National Occupational Health and Safety Commission
NRA	National Registration Authority
NSW	New South Wales

NT	Northern Territory
OECD	Organization for Economic Co-operation and Development
OGTR	Office of the Gene Technology Regulator
PBR	Plant Breeders' Right
Qld	Queensland
R&D	Research and Development
RBV	Resource-based View
SA	South Australia
SAM	Strategic Alignment Model
SIS	Strategic Information Systems
SISP	Strategic Information Systems Planning
SME	Small and Medium Sized Enterprises
SSM	Soft Systems Methodology
Tas	Tasmania
TGA	Therapeutic Goods and Drugs Administration
TRIPS	Trade-Related aspects of Intellectual Property rights
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organisation
UPOV	Union for the Protection of New Varieties of Plants
US	United States
USDA	United States Department of Agriculture
USPTO	United States Patent and Trademark Office
VMAC	Veterinary Medicine Advisory Committee
Vic	Victoria
WA	Western Australia
WHO	World Health Organisation
WIPO	World Intellectual Property Organisation
WTO	World Trade Organization

Table of Contents

VOLUME ONE

ABSTRACT.....	5
ACKNOWLEDGEMENTS	7
ACRONYMS	9
1 INTRODUCTION.....	17
1.1 INTRODUCTION	19
1.2 BACKGROUND.....	20
1.2.1 Information Systems Strategy.....	21
1.2.2 Strategic Management Theory.....	22
1.2.3 Small Business Context	23
1.2.4 IS Theory and Knowledge Management	24
1.3 RESEARCH CONTEXT	26
1.3.1 Integrating Perspectives	27
1.4 RESEARCH PROBLEM	28
1.4.1 Research Question	29
1.4.2 Research Objectives.....	29
1.4.3 Research Scope	30
1.5 SUMMARY OF CONTRIBUTION.....	32
1.6 CHAPTER SUMMARY	34
1.7 CHAPTER ONE REFLECTIONS	37
2 LITERATURE REVIEW	39
2.1 INTRODUCTION	41
2.2 BACKGROUND TO THIS RESEARCH	42
2.3 DEFINING ‘INFORMATION SYSTEMS STRATEGY’	43
2.4 EVOLUTION OF ISS THEORY.....	44
2.4.1 Strategic Alignment	46
2.5 STRATEGIC MANAGEMENT THEORY	48
2.6 INFORMATION SYSTEMS STRATEGY FRAMEWORKS	49
2.7 SMALL BUSINESS CONTEXT	53
2.7.1 Small Business Research	54
2.8 IS AND SMES	56
2.8.1 Strategic Use of IS in the SME Context	58
2.9 ISS AND SMES	60
2.10 KNOWLEDGE-BASED SMES (KSMEs)	63
2.10.1 Biotechnology Businesses - A Type of KSME.....	64
2.11 ISS AND KSMEs	65
2.12 IS THEORY AND THE EMERGENCE OF KNOWLEDGE	68
2.12.1 Definition of Knowledge	69
2.12.2 Knowledge Perspectives	70
2.12.3 Types of Knowledge	71
2.12.4 Nature of Knowledge.....	75
2.12.5 Knowledge Management	77
2.13 CRITICALLY DISPLAYS AN AREA WORTHY OF FURTHER INVESTIGATION - ISSUES FOR CURRENT ISS AND KNOWLEDGE MANAGEMENT THEORY	82

2.13.1	Considerations in Relation to Potential Limitations of the RBV	84
2.14	EXPLORING AN INTEGRATED APPROACH FOR ISS AND KNOWLEDGE MANAGEMENT	87
2.14.1	Business Model Concept.....	87
2.15	REFLECTING ON THE LITERATURE REVIEW TO 2003	94
2.16	REVIEW OF THE LITERATURE REVIEW POST DATA COLLECTION	94
2.17	CHAPTER TWO REFLECTIONS.....	100
3	BIOTECHNOLOGY OVERVIEW	103
3.1	INTRODUCTION	105
3.2	DEFINING THE TERM 'BIOTECHNOLOGY'	106
3.3	BIOTECHNOLOGY BASICS	108
3.3.1	The Science	108
3.3.2	Tools and Technologies	109
3.3.3	Application Areas	110
3.3.4	Product Development.....	112
3.3.5	Drug Discovery Process.....	112
3.4	BIOTECHNOLOGY AND ITS DEBATE.....	114
3.5	OVERVIEW OF THE GLOBAL BIOTECHNOLOGY SECTOR	116
3.5.1	Global Human Health Application Sector	117
3.5.2	Global Agricultural Application Sector	119
3.5.3	International Organisations/Agreements	119
3.5.4	Intellection Property Rights	121
3.5.5	Regulatory Environment	126
3.6	AUSTRALIAN BIOTECHNOLOGY INDUSTRY	128
3.6.1	Application Sector Overview in Australia.....	131
3.6.2	Overview of States Biotechnology Sector	132
3.6.3	Funding	135
3.6.4	Australian Regulatory Environment	137
3.6.5	Research Environment in Australia	138
3.7	STATISTICS ON THE BIOTECHNOLOGY INDUSTRY	138
3.8	CHAPTER THREE REFLECTIONS.....	140
4	RESEARCH METHODOLOGY	143
4.1	INTRODUCTION	145
4.2	ADDRESSING THE CHALLENGES IN RESEARCH DESIGN	147
4.2.1	Critical Reflection in Research Design	148
4.2.2	Commercial Sensitivity as Addressed in the Research Design	150
4.2.3	Overcoming the Restrictions of the Firm-Level Analytical Focus	154
4.3	RESEARCH PHILOSOPHY	155
4.3.1	Ontology	155
4.3.2	Epistemology	156
4.4	RESEARCH STRATEGY	157
4.4.1	Research Strategy - Familiarisation Stage	161
4.4.2	Research Strategy - Pilot Interviews.....	162
4.4.3	Research Strategy - Primary Investigation	165
4.5	RESEARCH PROCEDURES.....	175
4.5.1	Research Procedures - Familiarisation.....	175
4.5.2	Research Procedures - Pilot Interviews	176
4.5.3	Research Procedures - Primary Investigation	178

4.6	PRINCIPLES GUIDING THE APPROACH TO ANALYSING THE DATA	189
4.6.1	Key Data Analysis Techniques.....	190
4.6.2	Detailing the Data Analysis Approach	193
4.7	PROCEDURES FOR INTERPRETING AND DISCUSSING THE FINDINGS	215
4.8	CHAPTER FOUR REFLECTIONS	216

VOLUME TWO

5	DATA ANALYSIS	219
5.1	INTRODUCTION	221
5.2	DATA ANALYSIS - STAGE ONE	223
5.2.1	Overview of Coding Process	224
5.2.2	Core Categories.....	227
5.2.3	Exploring Relationships Between the Categories.....	257
5.2.4	Describing the Context	260
5.2.5	Development of a Descriptive Model.....	274
5.2.6	Summary of Reflections of Stage One of Data Analysis.....	277
5.3	DATA ANALYSIS - STAGE TWO.....	278
5.3.1	Stage Two - Part A - Case Level Analysis	278
5.3.2	Stage Two - Part B – Cross-Case analysis.....	283
5.3.3	Reflecting on the Five Types of Firms and the Emergence of Strategic Alignment	296
5.3.4	Summary Reflection on Stage Two Data Analysis.....	301
5.4	CHAPTER FIVE REFLECTIONS.....	302
6	INTERPRETATION AND DISCUSSION	305
6.1	INTRODUCTION	307
6.2	SUMMARY OF KEY FINDINGS FROM DATA ANALYSIS	308
6.3	INTERPRETING THE FINDINGS.....	311
6.3.1	Nature of ISS.....	312
6.3.2	Emergence of Strategic Alignment.....	315
6.3.3	Role of IT - Its Central Role and Three Hats	319
6.3.4	Outsourcing.....	321
6.3.5	Business Development and Product Development Focus	323
6.3.6	Emergence of a Knowledge Creation Context.....	325
6.3.7	Environmental Pressures.....	325
6.3.8	The Importance of the Human Element.....	325
6.3.9	Strategic Nature of Biotechnology KSMEs.....	327
6.3.10	Heterogeneity of Small Business	329
6.3.11	Reflecting on the Interpretation of Findings.....	330
6.4	REVISITING THE RESEARCH QUESTIONS: NATURE OF ISS AND STRATEGIC ALIGNMENT	331
6.4.1	Significance of Strategic Alignment.....	331
6.4.2	Developing an Explanatory Model of Strategic Alignment	333
6.4.3	Factors Influencing Strategic Alignment.....	341
6.4.4	An Interpretation of the Five Firm Types, Strategic Alignment and the Nature of ISS.....	346
6.4.5	Considerations for Applying the Framework	353
6.4.6	Reflecting on the Interpreted Significance of Strategic Alignment and Nature of ISS.....	354

6.5	IMPLICATIONS OF THE INTERPRETATION FOR APPROACHES TO ISS.....	355
6.5.1	Reassessing Strategic Alignment.....	356
6.5.2	Agent or Tool - Conceptualisation of IT.....	357
6.5.3	Nature of the Firm Boundary.....	358
6.5.4	Conceptualisation of SMEs.....	361
6.5.5	Socio-technical Perspective	362
6.5.6	Potential Implications for Knowledge Management Theory.....	363
6.6	IMPLICATIONS OF THE INTERPRETATION FOR UTILISATION OF STRATEGIC MANAGEMENT IN ISS THEORY	364
6.6.1	Reflecting on the Resource-Based View	365
6.6.2	Reflecting on the Relational View.....	367
6.6.3	Reflecting on the Industry Structure View	367
6.6.4	Reflecting on the Integrated Perspective	369
6.6.5	Summary Reflection on Strategic Management Theory Relevance..	372
6.7	CHAPTER SIX REFLECTIONS.....	372
7	CONCLUSION AND REFLECTION	375
7.1	INTRODUCTION	377
7.2	SUMMARY OF THE FINDINGS.....	377
7.3	CONTRIBUTION TO THEORY AND PRACTICE.....	380
7.3.1	Substantive Level Contributions.....	380
7.3.2	Methodological Level Contributions.....	380
7.3.3	Theoretical Level Contributions	381
7.3.4	Reflecting On the Application of Klein and Myers' Principles.....	382
7.3.5	Recommendations for KSMEs	386
7.3.6	Recommendations for the Australian Biotechnology Industry.....	388
7.4	LIMITATIONS OF RESEARCH APPROACH.....	388
7.5	FUTURE RESEARCH.....	392
7.6	CONCLUDING REFLECTIONS.....	394
8	REFERENCES.....	395
	APPENDICES.....	429
	APPENDIX A - FAMILIARISATION STAGE – INTERVIEWS WITH KEY INDUSTRY REPRESENTATIVES	431
	Analysis of Key Industry Interviews	433
	APPENDIX B - CANADIAN PILOT INTERVIEWS STAGE.....	434
	Critical Reflection on Canadian Pilot Interviews and Implications for Primary Data Collection	440
	APPENDIX C - PARTICIPANT DOCUMENTATION	443
	Email to Potential Participants Requesting their Participation	443
	Information Sheet for Interview Participants.....	444
	Consent Form signed by Interview Participants	446
	Email to Participants Post-Interview	447
	APPENDIX D - INTERVIEW FRAME	448
	Primary Data Collection Interview Frame.....	448
	APPENDIX E - PRIMARY CASE VIGNETTES.....	450
	APPENDIX F - CODING TABLES	463
	Stage One Data Analysis - Meta-case.....	463
	Stage Two Data Analysis - Coding Tables	470